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SUMMARY OF NATIONAL PAPER*

The intensified application of science and technology can contribute essentially to tapping natural resources and to developing production in less-developed countries (LDCs) to a level enabling them to find better solutions to their economic and social problems and to participate in world trade as equal partners. On the other hand, growing reliance on technology in the world today not only solves problems but also produces new ones. Besides the ecological limits to growth, economic and social bottle-necks are becoming increasingly apparent. For this reason, industrialization as a tool of development can no longer be regarded as a path leading from a state of under-development to a state without problematic issues, but rather as a process leading from one critical state to another.

For this reason, the assumption that the technological gap between developed countries (DCs) and LDCs can be bridged by the more or less wholesale transfer of technologies developed in DCs over-simplifies the situation. The key role is played not so much by the transfer of technology as by the innovation system in LDCs. The innovation system in LDCs has to find appropriate solutions to the problems of the physical and social environment of these countries and to pass them

* The designations employed, the presentation of material and the views expressed in this paper are those of the Government of the Federal Republic of Germany and do not necessarily reflect the practices and views of the Secretariat of the United Nations in any of these respects.

on to the production system. The strengthening of the innovation system in LDCs and its bridges to the indigenous production system in each case therefore takes priority.

This does not mean that LDCs can dispense with importing technologies until they have their own efficient innovation system. Rather, is it important that - in addition to the commercial transfer of technologies which leads directly to the production system in LDCs - other forms of co-operation be introduced which involve the innovation system in LDCs, thus strengthening it and paving the way for solutions geared to the specific requirements and conditions in LDCs.

Four complementary fields of action in co-operation in science and technology for development should, in the opinion of the Government of the Federal Republic of Germany, be distinguished.

Strengthening the innovation system in LDCs and its bridges to the production system in these countries is to be regarded as the most important task of medium-term planning, to be executed chiefly by LDCs themselves. The Federal Government is prepared to give intensified support to these countries' endeavours in this respect. Priority tasks would seem to be:

- the establishment and development of an indigenous scientific and technological infrastructure in LDCs, enabling them to evaluate and select foreign technologies and to plan and execute their own research and development activities, in particular: training and advanced training facilities; research establishments; and technology centres;

- integration of the scientific and technological infrastructure in the production system of LDCs: scientific and technological advisory services; measuring, standardization and testing institutions; and information and documentation centres.

Co-operation between the innovation system in DCs and the innovation system in LDCs carried out by research and development institutions on both sides has the effect of strengthening directly the innovation system in LDCs. The results of such co-operation also stimulate indirectly the production system in these countries. The LDC partner's familiarity with the problem in question facilitates co-operation in that technological solutions are selected which are oriented to the needs of the population, to the resources and manufacturing conditions in LDCs.

The Federal Government gives priority support to this form of co-operation by:

- advising LDCs on the establishment and development of their innovation systems;

- introducing institutional promotion measures, e.g. "twinnings";

- introducing problem-oriented promotion measures - namely, by offering LDCs the possibility of engaging in co-operation projects for which the research and development potential in the Federal Republic of Germany can be used. In the opinion of the Federal Government, the sectors of food and agriculture,

energy, natural resources, water and health are of special importance in this connexion. Use will be made of both the government-supported research establishments and of the research and development potential of universities and industry in the Federal Republic of Germany. Funds are provided, inter alia, within the framework of "scientific and technological co-operation" under the various national research and development programmes in the individual scientific sectors. For the purpose of rationalizing and optimizing these measures, the Federal Ministries competent for development and research and development policy are engaged in close co-operation including joint research and development projects for the benefit of LDCs, which co-operation is to be expanded further by the intensified involvement of science organizations;

- promoting co-operation also below government level, in order to contribute towards the integration of the international scientific community.

Co-operation between the innovation system in DCs and the production system in LDCs is probably expedient only in cases where the indigenous innovation system alone is not yet capable of meeting the urgent technological requirements of LDCs.

For the purpose of promoting this form of co-operation, the Federal Government has introduced a number of measures, the major objectives of which are as follows:

- reducing the information gap between existing research and development results and the knowledge available to LDCs for solving specific problems: by establishing a technological inquiry and information service in the Federal Republic of Germany for LDCs; and by opening up national information systems in the Federal Republic of Germany for the use of LDCs as a contribution to the international efforts to utilize the fund of existing scientific and technological information for development;

- promoting research and development projects in the Federal Republic of Germany for the adaptation of existing technologies and the development of new technologies to correspond with needs and conditions in LDCs;

- facilitating access to the results of its own research and development activities.

Co-operation between the production system in DCs and the production system in LDCs

The commercial transfer of technology influences the technological development of LDCs to a greater extent than the other forms of co-operation. The industries the establishment of which was made possible by such transfer of technology have become important pillars of growth in many of these countries. In some cases - particularly with regard to the transfer of capital-intensive technologies - it has, however, contributed little to solving the employment problem. Thus, the innovation system in LDCs is faced with the task of making a critical choice of technologies. In most cases, this choice will not result in the selection of one specific kind of technology, because only a combination of different kinds of technologies will prove appropriate for the conditions of economic dualism.

The commercial transfer of technology is effected via private enterprises on the individual decisions of which the Federal Government has no influence. The Federal Government does, however, promote the commercial transfer of technology by a number of measures:

- by granting loans, guarantees and tax reliefs;
- by participating in the financing of institutions for the promotion of co-operation with LDC enterprises;
- by constructive co-operation in international endeavours aimed at intensifying the commercial transfer of technology.

These measures on the part of the Federal Government should, wherever possible, be supplemented by complementary measures introduced by LDCs with the aim of:

- creating a good atmosphere for co-operation;
- establishing attractive conditions for the transfer of technology;
- protecting intellectual property;
- not restricting unduly the freedom of contract of co-operation partners.

Within the framework of economic co-operation, "financial co-operation" in particular contributes to the establishment of the physical infrastructure in LDCs, thereby supplementing the commercial transfer of technology, which as a rule requires the prior establishment of an initial infrastructure. Besides this, "financial co-operation" also promotes manufacturing enterprises, which in most cases are designed on a large-scale basis and which - as regards the commercial transfer of technology also - display a preference for capital-intensive solutions. In contrast, "technical co-operation" promotes agricultural and small-scale manufacturing enterprises in particular. The technologies transferred by this form of co-operation are more labour-intensive and better adapted to processes in the traditional sector. It should be emphasized that the direct promotion of the production system by providing advisory services only accounts for part of the various tasks under "technical co-operation". Other major tasks within the framework of this form of co-operation lie in the fields of action mentioned above and in connexion with the development of social infrastructures.

The Federal Government is prepared, inter alia, to:

- provide funds under economic co-operation in individual cases also for the acquisition of patents and licences by LDCs;
- finance domestic currency costs within the framework of "financial co-operation" if such a measure is necessary in order to promote less capital-intensive projects;
- continue its policy of providing untied loans.

The measures for training and further training carried out under all forms of co-operation are especially important. The Federal Government therefore:

- promotes on a priority basis the development and expansion of well-balanced training and further training systems in LDCs for skilled workers, technicians and university graduates;

- endeavours to make better provision for meeting the desire of LDCs for qualified staff in the training and further training sectors, including research;

- supports both the development and dissemination of teaching technologies specially designed to meet the requirements of LDCs;

- attaches particular importance to special training and further training measures accompanying projects to be implemented whenever possible in the respective LDC itself, in order to avoid the brain drain;

- counteracts the brain drain by executing reintegration programmes.

In the opinion of the Federal Government, its measures to tackle the brain drain problem need to be supplemented by endeavours on the part of the native countries of skilled staff, particularly by the better orientation of their training to requirements and employment chances in the respective countries.

In order to be effective, international co-operation in the sector of science and technology requires flexible mechanisms. At the national, regional and global levels it therefore has to take into consideration the interdependence of both national and multilateral activities. It should focus on improving the living conditions and standard of living of man. The Federal Government therefore regards activities oriented to actual local and regional requirements as the priority area of co-operation with LDCs on a partnership basis. In this connexion, particular importance is attached to technological co-operation between LDCs. The promotion of such co-operation is primarily a task for the international organizations. The Federal Government will continue to support this co-operation on a bilateral basis.